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ABSTRACT

This paper identifies possible causes of the disjuncture between theory and practice in teacher preparation and recommends strategies for incorporating instructional technology, as defined by the Association for Educational Communication and Technology in 1994, and distance education into teacher preparation programs. Causes of the theory-practice gap include the strong relationship between how novice teachers teach and how they were taught; novice teachers' needs to encounter authentic, real-world problems in order to find relevance; and classroom teachers' needs for action-guiding knowledge to make timely decisions, rather than the more general abstract knowledge presented in teacher education. Preventive solutions include: teaching instructional systems design (ISD) planning processes and practices; modeling constructivist principles when designing instruction (focusing on knowledge construction, authentic learning contexts and collaboration among learners and with the teacher); and adapting instructional practices of distance education to the on-campus environment (using ISD models and processes to meet the diverse needs of all learners, maximize interaction, and ensure timely feedback). (Contains 38 references.) (SM)

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Theory to Practice: Utilization of Instructional Systems Design, Constructivist Pedagogy, and Distance Learning Strategies in Preservice Teacher Preparation

by

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Theory to Practice: Utilization of Instructional Systems Design, Constructivist Pedagogy, and Distance Learning Strategies in Preservice Teacher Preparation

Introduction

Creative tension as defined by Senge (1990) is the gap between an existing situation, current reality, and that ideal future that one truly desires to create. It is this gap that generates energy for change; if there were no gap, there would be no need to create a better realty. Nowhere is this gap more apparent than in our educational systems today. In May 1999, C. Emily Feistritzer, President of the National Center for Education Information in Washington, D.C. appeared before the House Committee on Education and the Workforce. Her testimony addressed the growing need for more and better teachers (Feistritzer, 1999a). Years earlier, Goodlad (as cited in Korthagen & Kessels, 1999) stated that teacher education programs are not preparing prospective teachers for the real world problems encountered in the classroom. LaBaron and Bragg (1994) concurred that teacher education programs have not been responsive to the changes that are occurring in schools. "If technology applications designed for constructivist learning are valid for emerging school practice, then they should infuse teacher preparation, as well" (p.6).

The purpose of this paper is twofold: (1) to identify possible causes of the disjuncture between theory and practice in teacher preparation, and (2) to recommend strategies for incorporating instructional technology, as defined by AECT in 1994 (Seels & Richey, 1994), and distance education into teacher preparation programs.

The problem

Teacher training programs exist to ensure that novice teachers are able to transfer theoretical knowledge and apply the most effective teaching practices in appropriate situations. "In addition, it is important to instill a sense of efficacy in those who are being prepared to ensure that they have the confidence to attempt to apply their knowledge when the appropriate time comes" (Gorrell & Capron, 1990, p. 15). However, in a survey

conducted by the National Center for Education Information in 1996, teachers were asked to rank the value of eight variables in developing competency to teach. 97% of the respondents said that there own teaching experience was most valuable. Only 37% ranked education courses and inservice activities as valuable. College of education faculty were ranked least valuable to teachers in developing their competency to teach (Feistritzer, 1999b).

The problem, then, is the gap between educational theory and educational practice, resulting in unfulfilled expectations and subsequent dissatisfaction with the teacher preparation programs. Although a myriad of solutions, from legislative mandates to alternative teacher certification to market-based education have emerged, it is this writer's opinion that, short of a new educational paradigm called for by Reigeluth (1995), there are preventative measures that can be initiated from the bottom up to narrow the theory/practice gap. These short-range, temporary solutions pertain to how teacher educators communicate knowledge to preservice teachers.

Causes of the theory to practice gap

Citing from the literature, Korthagen and Kessels (1999) listed three causes of the problem of poor transfer from teacher education to practice: (a) there is a strong relationship between the way novice teachers teach and the way in which they were taught; (b) to find relevancy in theory, novice teachers must encounter authentic, real-world problems; and (c) classroom teachers need action-guiding knowledge to make timely decisions, rather than the more general abstract knowledge presented in the teacher education programs.

A shift in student demographics compounds the problem of knowledge transfer. Herrera and Fanning (1999) discussed the need to prepare teachers to meet the challenge of teaching a diverse student population. Although demographic analyses project an increase in cultural and linguistic diversity, the issue of teacher preparation for diversity has received only marginal attention. Courses and in-service workshops on diversity tend to

describe cultural differences rather than to explore the pedagogical implications of diversity and specific instructional strategies that can be used in the classroom to accommodate the needs of diverse learners (Kennedy, 1991). Not only is there a difference in the backgrounds of teachers and their students, but there is a both a cultural and gender contrast between teacher educators and prospective teachers (Zeichner, 1996).

Preventative solutions

Because of the paradigm shifts in society, teacher preparation is in need of what Fullan (1996) referred to as reculturing and restructuring. Reculturing is the development of new values, beliefs, and norms; restructuring is the change in roles, structures, or other mechanisms that ensure that the new cultures flourish. Fragmented, piecemeal, quick-fix solutions have been proven ineffective (Goldenberg & Gallimore, 1991; Reigeluth, 1995). There are, however, certain changes that teacher educators can initiate right now to enhance knowledge communication between teacher educators and prospective teachers. This writer suggests three: (a) teach ISD planning processes and practices; (b) model constructivist principles when designing instruction; and (c) adapt instructional practices of distance delivery to the on-campus environment.

Teach ISD planning processes and practices. In methods courses, prospective teachers practice the process of lesson planning. Typically, the planning model entails stating objectives, then selecting and ordering instructional strategies. Each instructional strategy is to be followed by an evaluation activity to assess the effectiveness of the strategy, ideally in light of the stated learning objectives. At the end of the lesson the teacher should reflect on personal performance as well as effectiveness of activities to improve future lessons (Anspaugh & Ezell, 1998). This objectives-first phase of instructional development traditionally considers instruction from the perspective of content rather than from the perspective of the learner (Kemp, Morrison, & Ross, 1996).

Although preservice teachers are taught this objectives-first planning model (Reisner, 1994), several studies have investigated how teachers actually plan. The

following conclusions may be drawn from the literature: (a) among novice teachers, there is a lack of academic preparation and/or professional training in the discipline of instructional development (Kennedy, 1994; Reisner, 1994); (b) when teachers plan, the emphasis is on content and activities (Driscoll, Klein, Sherman, 1994; Reisner, 1994); (c) mental planning plays an important role in the planning processes of teachers (Reisner, 1994) and phases of planning tend to be reticular, versus existing separately (Driscoll, Klein, & Sherman, 1994); (d) planning processes and beliefs change as teachers gain teaching experience (Reisner, 1994), with experienced teachers focusing more on the general nature of instruction and the variables affecting teaching and learning (Driscoll, Klein, Sherman, 1994); and (e) planning is greatly influenced by public examinations (Kennedy, 1994). Most interestingly, although teachers noted that university training programs did not prepare them with theoretical knowledge for instructional development, "...more than 50% felt they could use an instructional development approach if they chose to do so" (Kennedy, 1994, p.20).

Dana (1997) determined that after completing a ten week course on the instructional design of software, graduate teachers did increase their awareness and concern for the use of design principles, but believed that preparation time was a major barrier to the utilization of the ID process. Earle and Sheffield (as cited in Dana, 1997) listed three additional discrepancies in traditional instructional development employed by teachers and the requirements for the process of ID: (a) teachers generally make mental plan whereas designers create detailed plans on paper; (b) teachers use prepared materials whereas designers develop materials that are context specific, and (c) teachers focus on instructional activities whereas designers focus on the process and the product. It is this writer's opinion that meaningful dialog addressing these differences would assist teachers to develop a personal rationale for incorporating ID into the daily planning processes, an effort well worth the time commitment.

Since lesson planning is one component of teacher-based instructional design (Smith & Regan, 1999), novice teachers could be taught the relationship between developing classroom instruction and both ID and ISD. This concept could then be reinforced in other methods courses. Dick and Reisner (as cited in Reisner, 1994) developed a simplified systems approach to instructional planning for preservice and inservice teacher. This model consists of 12 hours of instruction, focusing on four systems-approach principles:

> 1. Teachers should clearly identify the objectives they expect their students to attain.
> 2. Teachers should plan and present instructional activities that are clearly intended to help students attain those objectives.
> 3. Teachers should develop and administer assessment instruments that clearly measure student attainment of those objectives.
> 4. Teachers should revise their instruction and provide remediation to students in light of the degree to which students attain each objective (p.11).

Reisner (1994) concluded, however, that even with this training, it is unlikely that teachers will employ the systems-approach model unless there is adequate time for practice and feedback on its use.

Model constructivist principles. Although teacher educators teach about constructivist learning theory, they do so in a traditional learning environment. Both teacher educators and prospective teachers have had years of experience with the transmission model of learning and may feel uncomfortable with their new roles as well as with the "...ambiguity that necessarily accompanies real-world and complex problems" (Carr, Jonassen, Litzinger, & Marra, 1998, p 10).

A preventative solution would be to integrate learning theory and practice by utilizing a constructivist design model (Jonassen, 1994) and incorporating constructivist strategies throughout the teacher preparation curriculum, whenever appropriate for a learning problem. Such strategies include, but are not limited to, collaboration, situated learning, case-based instruction, anchored instruction, and learning communities.

A constructivist design model. The emphasis in constructivist design is the design of learning environments conducive to knowledge construction as opposed to the design of

instructional sequences. Jonassen (1994) listed seven attributes of constructivist learning environments:

- represents the natural complexity of the real world
- focus on knowledge construction, not reproduction
- present authentic tasks, contextualizing, rather than abstracting instruction
- provide real-world, case-based learning environments, rather than predetermined instructional sequences
- foster reflective practice
- enable context- and content-dependent knowledge construction
- support collaborative construction of knowledge through social negotiation, not competition among learners for recognition (p. 35)

To summarize, the design of constructivist learning environments should emphasize three processes: knowledge construction, authentic learning contexts, and collaboration both among learners and with a teacher who functions as a mentor and coach (Jonassen, 1994).

Willis (1995) described an ID model that is based on constructivist theory. Called R2D2, it is a non-linear, recursive, reflective, participatory design model that is appropriate for a teacher education curriculum. Emphasis is on context and the creation of instructional materials. Decisions evolve from the design process. "...the instructional design process is viewed as a learning process in which learning leads to improvements to the instructional material under development" (p.16). If cognitive modeling (Gorrell & Capron, 1990) is used as a knowledge transmission technique during the R2D2 design process, it is possible that learners will better understand the causes underlying the ambiguity of the constructivist design process.

Collaboration. There is little disagreement as to the value of collaboration in the learning process; however, as pointed out by Podeschi and Messenheimer-Young (1998), the process of team-teaching has received little research attention. By merging courses, integrating content, and team-teaching, faculty are able to model collaboration and professional inquiry or reflection on the collaborative process.

In an interdepartmental team-teaching pilot project, Podeschi and Messenheimer-Young (1998) discovered insights into the relatedness of course content, classroom dynamics created by a team-teaching process, as well as dilemmas evolving from the experience. Faculty not only became more explicit about personal philosophies of teaching and evaluation, but recognized distinct differences in teaching styles. By reasoning aloud and discussing these differences, prospective teachers became more reflective about their own teaching/learning assumptions. Although three dilemmas emerged during the project--time commitment, faculty differences, and resocialization--the team-teaching effort did encourage dialog among teacher educators, indicating the power of practice in initiating reform.

Taken one step further, team-teaching increases communication and collaboration, and both processes are critical to successful technology infusion into the learning environment. Zorfass and Remz (1992) cited two case studies to illustrate the value of ongoing communication and collaboration to technology integration.

> Because teachers had the support, knowledge, and expertise of others to draw upon, they were more likely to use computers in a sustained way; more likely to use them in ways that connected to the school's mission, curriculum goals, and student needs; and more likely to find strategies that worked to help all students benefit from technology" (p.42).

Authentic learning contexts. A cooperative program between the Flagstaff School District and Northern Arizona University illustrates the epitome of an authentic learning environment. Portable units have been placed at the four host schools and university faculty and teacher education students actually "live" in the host school every day. Host teachers volunteer to mentor their apprentices. Course content is based on everyday experiences and classroom teachers, teacher educators, and prospective teachers exchange ideas and share materials as informal inservice training (VerVelde, Horn. & Steinshouer, 1991).

But what are options are available to the majority of novice teachers who do not have the opportunity for this total immersion into a school environment? Korthagen and

Kessels (1999) discussed the need for a paradigm shift in teacher education to a realistic approach--an integration of theory and practice--where learning begins with practice and moves to theory.

> An interesting aspect is that the gap between theory and practice disappears, although it is better to say that it is not created by the education process itself, as is the case in the traditional approach (p. 7).

While this paradigm shift requires both restructuring of the teacher education curricula and a redesign of instructional interventions and strategies, Utrecht University has gradually developed a more realistic approach to teacher education. Studies focusing on the effectiveness of program design in reducing the gap between theory and practice indicate that:

> Concrete learning effects on the work of the graduates during their first year in the profession...appeared to depend primarily on the degree to which the theoretical elements in their preparation program were perceived by the student teachers as functional for practice at the time of their student teaching and on the cyclical alternation between schoolbased and university-based periods in the program. Also, a gradual increase in the complexity of activities and demands on the student teachers appeared to be a crucial factor in integrating theory and practice (p. 15).

Case-based instruction. The goal of total immersion in the workplace, increased school-based experience, and integrating theory and practice is to increase the relevancy and meaning-making of knowledge construction. Case-based instruction is another alternative to bridge the gap between theory and practice (Ashbaugh & Kasten, 1991; Merseth, 1991 as cited in Ertmer & Russell, 1995). In teacher education, cases serve as representations of actual classrooms. Merseth (1998) defined cases as descriptive research documents based on real-life situations and created for discussion and analyses from multiple perspectives. Case methods defines how cases are used. In teacher education, casebooks contain collections of cases that can be used in a variety of ways.

> Case methods are employed, for instance, to frame conversations between mentors and novices, as stimulants to reflection, as techniques to enrich field experiences, as tools for professional evaluation, or to orient individuals to a particular way of thinking.

Technology to support authentic learning. Based upon theories of situated learning and cognitive flexibility theory, the Cognition and Technology Group at Vanderbilt (1993) has utilized interactive videodisc to provide students with authentic environments to solve real-world problems. The paradigm for this technology-based learning is called anchored instruction and is based on two principles: (a) learning and teaching activities should be designed around a macrocontext or anchor that is usually a case study or problem situation, and (b) the curriculum materials should encourage exploration by the learner. The purpose of anchored instruction is to help students develop the skills, knowledge, and efficacy to solve problems and become independent learners (CTGV, 1990).

Of course, anchored instruction is not without its challenges to teachers. The classroom must be recultured. Anchored instruction is a means of shifting from a teacher-centered to a student-centered learning environment. Teachers will be assuming new roles as mentor and even fellow learner. As students explore the anchors, they are encouraged to generate their own questions, identify a need for new learning, and to set learning goals. This necessitates that the teacher be both flexible and willing to allow instructional plans to evolve during the learning process.

Two additional challenges are not unique to anchored instruction; rather, they are characteristic of constructivist teaching: (a) how to provide guidance in a non-directive way and (b) how to utilize anchored instructional material in a context mandating standardized testing. This latter challenge deserves brief comment. The goal of CTVG has not been to improve performance on standardized achievement tests, but to help students develop the skills, knowledge, and efficacy to solve problems and become independent learners.

> Our *hope* has been that we could show impressive gains on assessments of complex problem solving, while not causing our students to lose ground on achievement tests. Our *fear* has been that the time taken from the traditional curriculum in order to do Jasper would cause a decline on scores on standardized tests. So far our fear has not been realized and, in some cases, we have even found significant advantages for our experimental groups on standardized achievement measures (Pellegrino, et al., 1991, as cited in CTGV, 1993, p.59).

CTGV first designed videodisc anchors because the tools were both "teacher friendly" and "budget friendly". Currently, CTGV is designing and testing computer simulations that allow learners to change parameters within the situation to make predictions and engage trial and error learning rather than reasoned decision making (CTGV, 1993). Computer simulations as anchors encourage "what if" thinking and help students systematically organize their work.

Applications of technology in teacher education. The University of Central Florida provided two hands-on workshops for educators in the use of instructional technology. The goal of the advanced workshop was to solve one of the subproblems presented in the videodisc anchor and to present a collaborative solution using PowerPoint. As groups of learners moved through various technology workstations, they were able to apply new learning to their specific project (Baumbach, Brewer, & Bird, 1995).

Goldman and Barron (1990) used both videodisc and hypermedia to help beginning teachers relate theory to practice by providing a classroom situation to illustrate teaching skills and strategies. The technology employed requires a computer, videodisc player, video monitor, & projection device for the computer screen. Initially, edited segments of videotape were used to accompany lectures and course activities. Not only was the process time-consuming since tapes had to be edited for each class session, but the linear sequence of the video scenes made class activities somewhat inflexible. Subsequently, video examples were pressed into video discs which held 30 minutes of video and had the advantage of instant access to any frame of the video on the disc. The videodisc player was then connected to a computer into which a sequence of video segments were preprogrammed Finally, using HyperCard to control the videodisc player, card stacks and video examples were be used to produce "cases" for group discussion and analysis.

Adapt instructional practices of distance delivery to the on-campus environment

Because of the geographic separateness between teacher and learner, Wagner and McCombs (1995) described the context of distance education as a catalyst for the infusion of learner-centered instructional strategies into the traditional teaching/learning environment. Distance educators are more likely to employ instructional design models and processes to meet the diverse needs of adult learners, to maximize interaction, and to ensure timely feedback. Interestingly, "...the accommodations made to adapt instructional experiences for distance delivery tend to mirror the types of 'best practice' recommendations which have been articulated in the Learner Centered Psychological Principles and reiterated in constructivist approaches to instructional design" (Wagner & McCombs, 1995, p.35).

Martin (1994) recommended using a distance learning context to teach instructional design principles. This recommendation is based on three presumptions: (a) ISD is rarely used in public schools because teachers think it is too time consuming and to restrictive, (b) the effectiveness of a distance learning course is dependent upon its design, and (c) students are attracted to the novelty of using technology in an instructional setting. For the instructor teaching ISD, the distance learning context provides an authentic environment in which to demonstrate need for not only the process of ISD, but applications of systems theory, learning theory, conditions of learning, media selection and message design, field testing, and formative/summative evaluations. It this writer opinion that the richness of the experience could be enhanced by incorporating an interdisciplinary, team-teaching approach to the content. For the student,

> Using some class time to see a distance class in session, participating in a teleconference, or allowing students a chance to experiment with the technology will give them an experiential base for designing a unit of instruction (Martin, 1994, p. 54).

One other design issue related to a distance environment is the need to use technology to support communities of learners (Jonassen, 1995; Moller, 1998). Jonassen (1995) contends that the true value of technology is to facilitate thinking and knowledge

construction. With proper design, technology can be used as tools, intellectual partners, and context to engage learners in knowledge construction, conversation, articulation, collaboration, and reflection.

Moller (1998) contends that media selection and design must facilitate learning beyond learner-content interaction and support learner communities. The purpose of a distance learning community is to lessen the feelings of isolation created by the nontraditional learning environment and to provide a platform for collaboration and the resultant knowledge construction. While asynchronous learning provides an opportunity for knowledge-building because of the time flexibility to discuss, investigate, and construct, information exchange activities must be prudently designed, developed, and implemented.

> Developing the communities is a potential outcome of the symbiotic relationship between instructional design and technology. Use of technology does not spontaneously cause communities to occur; communities of learners must be planned. However, technological tools allow instructional designers to use specific strategies to create the communities. Following a traditional instructional-systems-design process, the four stages of (a) analysis, (b) assessment, (c) design, and (d) development must be either emphasized or adapted for the communities to develop (Moller, 1998, p. 120).

As part of a collaborative partnership among educational institutions, government, and industry, the teacher education program at Armstrong Atlantic State University uses two-way, interactive, compressed video to extend campus-based courses to clinical settings and to provide preservice teachers with direct experience using distance learning technology. After using technology from a learners perspective, these rationale future teachers will be more likely to make technology an integral part of their teaching integrate technology into their own classrooms (Cosgrove, 1997). Isolation resulting from the physical distance between the university and the site of student teaching is reduced by the use of telecommunication technologies. Preservice teachers and their methods course professor have increased opportunity to observe and analyze learning in the classroom without being obtrusive. Distance learning technologies also provide increased contact

among the preservice teacher, school supervisor, and university faculty as a supplement to the face-to-face meetings.

Computer technologies are also used in field-based preparation of teachers (Brush, Knapczyk, & Hubbard, 1994). This allows teachers to remain at their school sites, yet have access to university faculty to discuss concerns of their everyday teaching responsibilities. A unified training program is the result of integrating traditional coursework and practical experience, using telecommunication technologies for interaction. Teachers only meet with their trainers three times during the semester. The training is then delivered to the site via four technologies: audiographics, teleconferencing, fax, and an electronic collaborative toll called TT-Mail.

As a preventative measure, then, teacher educators can enrich traditional courses by infusing time and place separation and utilizing available technologies to create communities of learners for asynchronous information exchange and social reinforcement. Drawing parallels between designing for distance learning and ISD should help novice teachers recognize the benefit of using ISD, or at least aspects of ISD, in any instructional setting.

Conclusions

Branson (1987) cited four reasons why systems fail: obsolescence, overload, design flaws, and/or inadequate management. Today, many teacher education programs manifest symptoms of all four underlying causes. There is a need for systemic change, but there is much that can be done to prepare for a recultured and restructured teacher training program. This writer is encouraged by the literature on the nature of change. An understanding of diffusion theory to forecast adoption is critical for the teacher educator envisioning integration of theory and practice. Itzkan (1996), identified three phases of change: (a) the substitution phase wherein a technology does not impact a current paradigm, but allows an existing practice to be duplicated or, at best, automated; (b) the transition phase wherein the technology challenges old models; and (c) the transformation phase wherein the technology supports new paradigms to replace obsolete models.

Adequate time must be allowed for all levels of the institutional hierarchy to prepare for the change (Rutherford & Grana, 1995).

Collins (1991) envisions the computer's place in work as providing impetus for technology integration into the classroom. In turn, where schools that have adopted computers, there has been a concomitant diffusion of constructivist theory and practice.

> Schools are in the business of teaching student how to read and write and calculate and think. As the computer becomes an essential tool for doing these things in society at large, its use by students is inevitable. We do not teach people how to drive cars by having them ride bicycles, now will we teach people how to do computer-based work by having them use paper and pencil, arithmetic procedures, and library card catalogs (p. 31).

Funk and Brown (1994) observed that there is a great potential for a symbiotic relationship between business and education because what business wants from education is congruent with the visions of educational reformers. There are basic skills that are necessary to reach the mainstream of society. These skills include the ability to: (a) write and speak effectively, (b) solve problems, (c) research information (d) use technology, and (e) work collaboratively and cooperatively.

Teacher educators must seize the opportunity provided by the symbiotic relationship between technology and ISD to model the knowledge and skills needed by future teachers to merge a variety of technologies into teaching/learning strategies that will motivate a diverse student population to prepare for a global society characterized by change.

The point is that teacher education cannot afford to ignore the context in which it exists. Nor can it afford not to coevolve with others in that environment. Moore (1997) discusses four stages of a business ecosystem with stage 4 being the geriatric stage. At this time a system must either renew itself, change with changing environmental conditions, or face obsolescence. Teacher education is at stage 4. There are three unanswered questions:

1. Will we renew ourselves?
2. Will we wait to be repaired by another system? or,
3. Will we simply be replaced by "...a new ecology that offers greater customer value (Moore, 1997, p. 80)?

Those who are *doing something* now are at least prolonging the useful life of the system of teacher education by taking the risk of transfusing innovation.

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